



# Results from CY2016 – CY2018 DNREC Impact and Process Evaluation

EEAC Meeting – January 8, 2020



# Evaluation Team Introduction

- **EcoMetric Consulting** conducted the **CY2016-2018** evaluation of DNREC's energy efficiency and renewable energy programs:
  - Energy Efficiency Investment Fund (EEIF)
  - Weatherization Assistance Program (WAP)
  - Green Energy Program (GEP)
- **Today's Speaker:**
  - Salil Gogte, President, EcoMetric
- **Project Team Leads:**
  - Kyle McKenna, Senior Energy Engineer, EcoMetric
  - Monica Nevius, Director, NMR Group Inc.

# Agenda

1. Evaluation Philosophy

2. Evaluation Activities

3. Portfolio Results

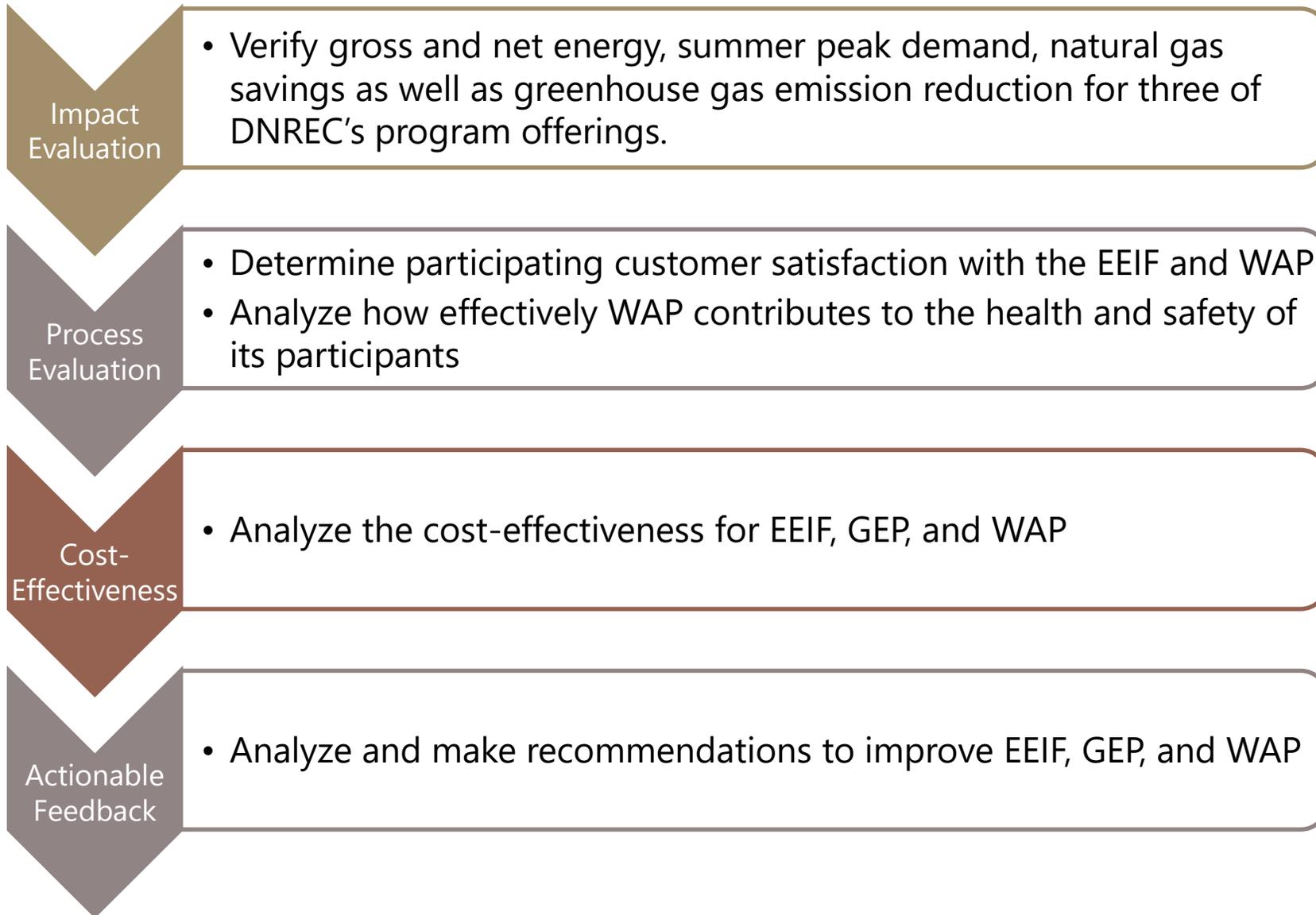
4. Cross-Cutting Activities

5. EEIF Results

6. WAP Results

7. GEP Results

# 1. Evaluation Philosophy



# 2. Evaluation Activities

Program	Program Year	Impact Evaluation	Process Evaluation	Cost-Effectiveness Calculation	Non-Energy Benefits	Greenhouse Gas Estimation
<b>EEIF</b>	2016 - 2018	✓	✓	✓		✓
<b>WAP</b>	2016 - 2017	✓	✓	✓	✓	✓
<b>GEP</b>	2016 - 2018	✓		✓		✓

# 3. Portfolio Level Summary: Gross Verified Savings

Electric Results					
Program	Reported Energy Savings (MWh)	Reported Peak Demand Savings (MW)	Verified Energy Savings (MWh)	Verified Peak Demand Savings (MW)	Energy Savings RR (%)
EEIF	20,455	-	20,652	2.03	<b>101%</b>
GEP	-	-	13,725	10.68	N/A
WAP	367	0.02	562	0.24	153%
<b>Total</b>	<b>20,822</b>	<b>0.02</b>	<b>34,939</b>	<b>12.95</b>	<b>168%</b>

Fossil Fuel Results			
Program	Reported Fossil Fuel Savings (MMBtu)	Verified Fossil Fuel Savings (MMBtu)	Fossil Fuel Savings RR (%)
EEIF	8,634	1,093	13%
WAP	5,031	4,210	84%
<b>Total</b>	<b>13,664</b>	<b>5,303</b>	<b>39%</b>

# 3. Portfolio Level Summary: Net Verified Savings

Electric and Fossil Fuel Results			
Program	Net Verified Energy Savings (MWh)	Net Verified Peak Demand Savings (MW)	Net Verified Fossil Fuel Savings (MMBtu)
EEIF	16,250	1.59	765
WAP	562	0.11	4,210
<b>Total</b>	<b>16,813</b>	<b>1.70</b>	<b>4,915</b>

### 3. Portfolio Level Summary: Cost-effectiveness Results

Program	NPV of Program Benefits	NPV of Program Costs	TRC Benefit-Cost Ratio
EEIF	\$26,936,669	\$10,294,802	2.62
GEP	\$50,765,366	\$51,666,001	0.98
WAP	\$3,730,998	\$2,181,096	1.71
Total	\$81,433,033	\$64,141,899	1.27

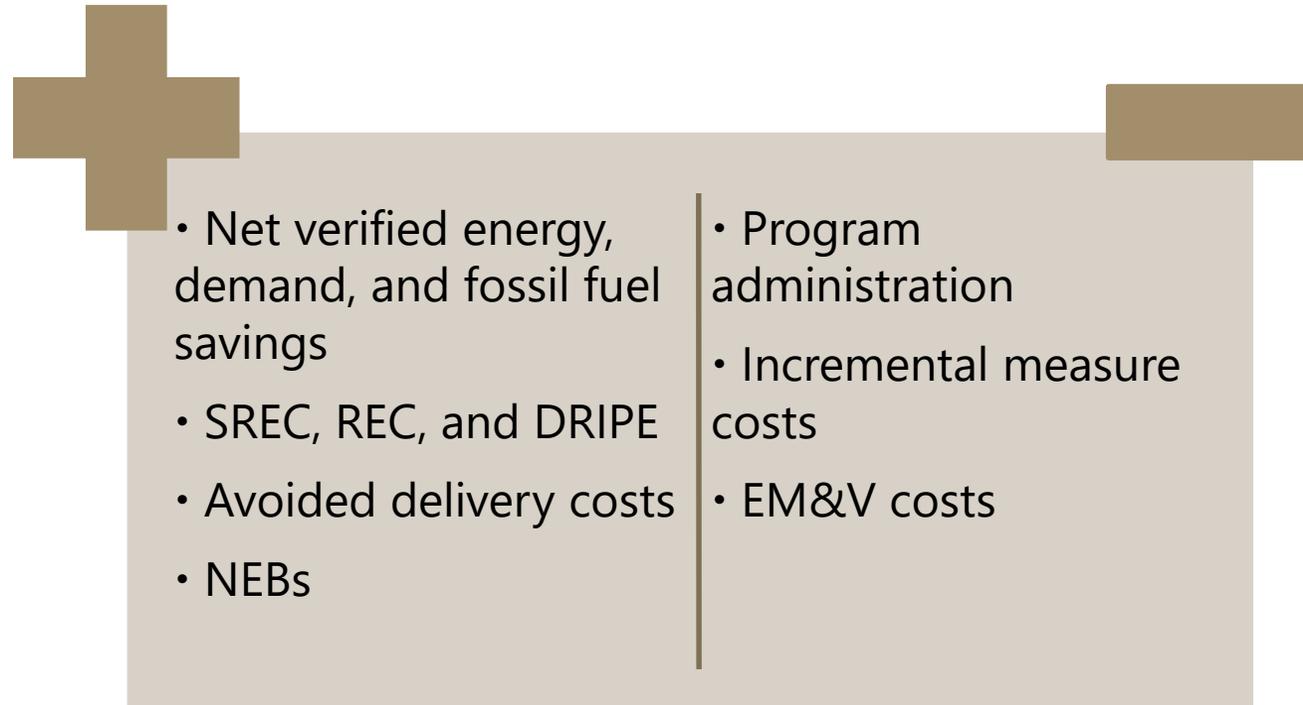
Net Present Value (NPV) = today's value of the lifetime saving

## 4. Cross-Cutting Activities: Greenhouse Gas (GHG) Approach



## 4. Cross-Cutting Activities: Cost-Effectiveness

$$TRC \text{ Benefit Cost Ratio} = \frac{NPV \text{ of Benefits}}{NPV \text{ of Costs}}$$



# 5. EEIF: Sample Frame Coverage

Project Type	Stratum	Population			Sample				
		Projects	Energy Savings (MWh)	Gas Savings (MMBtu)	Sample Points	Sampled MWh	Percent MWh	Sampled MMBtu	Percent MMBtu
Prescriptive	Certainty	5	3,648	0	5	3,648	18%	0	0%
	Large Probability	22	7,023	0	13	4,084	20%	0	0%
	Small Probability	180	7,095	0	32	1,884	9%	0	0%
Custom - Electric	Certainty	1	602	0	1	601.89	3%	0	0%
	Probability	52	1,360	0	17	636	3%	11	0%
Custom - Gas	Certainty	3	0	6,967	3	0	0%	6,967	81%
	Probability	7	727	1,667	3	617	3%	1,156	13%
Total		270	20,455	8,634	74	11,471	56%	8,134	94%

# 5. EEIF: Gross Verified Savings

Measure Type	Number of Projects	Electric Realization Rate	Gross Verified Energy Savings (MWh)	Relative Electric Precision at 90% Confidence	Gross Verified Peak Demand Reduction (MW)	Gross Verified Gas Savings (MMBtu)	Relative Precision Gas at 90% Confidence
Prescriptive	207	103%	17,938	7.5%	1.66	0	NA
Custom – Electric	53	72%	1,980	7.5%	0.22	0	NA
Custom – Gas	10	90%	734	NA	0.16	1,093	14%
<b>Total</b>	<b>270</b>	<b>101%</b>	<b>20,652</b>		<b>2.03</b>	<b>1,093</b>	

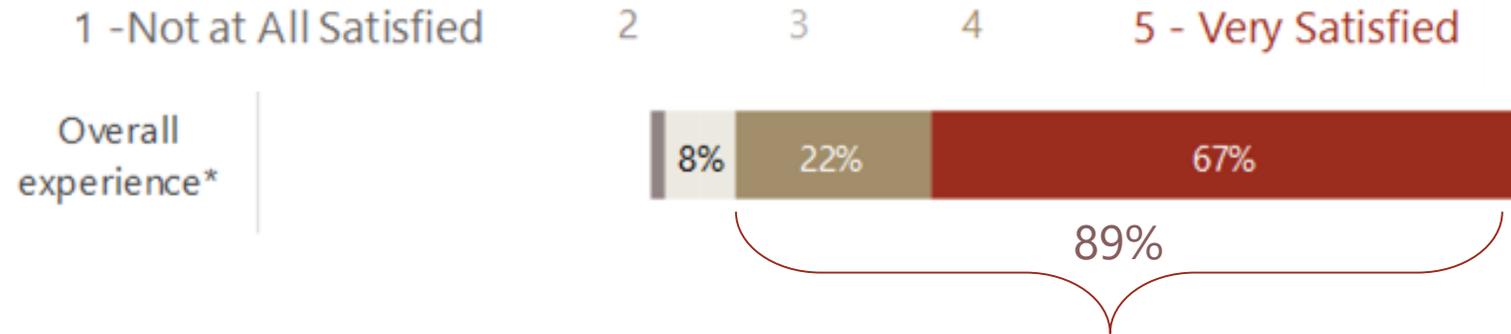
# 5. EEIF: Net Verified Savings

Measure Type	Approved C&I NTG	Net Verified Energy Savings (MWh)	Net Verified Peak Demand Reduction (MW)	Net Verified Gas Savings (MMBtu)
Prescriptive	0.8	14,350	1.33	0
Custom – Electric	0.7	1,386	0.15	0
Custom – Gas	0.7	514	0.11	765
Total		16,250	1.59	765

# 5. EEIF: Evaluation Key Findings

- The EEIF program achieved a **101%** realization rate for gross electric savings
  - Reported savings for lighting projects did not utilize waste heat factors
  - Not all prescriptive projects followed savings methodology in Mid-Atlantic TRM
- The EEIF program achieved a **13%** realization rate for gross natural gas savings
  - Technical baselines for custom projects were considered to be major renovation
  - Net MMBtu to calculate savings for Fuel Switching projects
- Projects increased in size (claimed savings) and complexity from 2016 to 2018
- EEIF was found to be a cost-effective program with a TRC ratio of **2.62**
- Lifetime GHG reduction of **177,944** tons from projects completed in CY2016-2018

# 5. EEIF: Process Evaluation Results



- **Customer satisfaction very high**
- **Contractors generally satisfied with EEIF experience, but**
  - Pre-approval process could be faster
  - Documentation requirements could be streamlined, made easier
  - Want to be listed as service providers on EEIF website
- **Formal mechanism for marketing and outreach may improve participation**

# 6. WAP: Program Reported Savings

Program Year	Projects Completed	Gas Savings (MMBtu)	Energy Savings (MWh)	Demand Savings (MW)
2016	202	2,262	169	0.02
2017	243	2,769	198	0.02
<b>Total</b>	<b>445</b>	<b>5,031</b>	<b>367</b>	<b>0.04</b>

Fuel Type	Projects Completed	Gas Savings (MMBtu)	Energy Savings (MWh)	Demand Savings (MW)
Electric	127	0	246	0.04
Gas	102	1,614	39	0.00
Gas/Electric	1	16	0	0.00
Kerosene	2	32	1	0.00
Oil	81	1,281	31	0.00
Oil/Electric	1	16	0	0.00
Propane	131	2,072	50	0.00
<b>Total</b>	<b>445</b>	<b>5,031</b>	<b>367</b>	<b>0.04</b>

# 6. WAP: Gross Verified Savings

Heating Type	Home Type	Number of Homes	Electric Realization Rate	Gross Verified Energy Savings (MWh)	Peak Demand Reduction Realization Rate	Gross Verified Peak Demand Reduction (MW)	MMBtu Realization Rate	Gross Verified
Electric	Single Family	94	107%	195	149%	0.04	NA	NA
	Manufactured Home	33	53%	34	18%	0.00	NA	NA
Natural Gas	Single Family	93	284%	101	NA	0.02	61%	895
	Manufactured Home	9	223%	8	NA	0.00	103%	146
Other Fuel	Single Family	72	314%	86	NA	0.01	67%	768
	Manufactured Home	144	254%	139	NA	0.03	105%	2,400
<b>Total</b>		<b>445</b>	<b>153%</b>	<b>562</b>	<b>301%</b>	<b>0.11</b>	<b>84%</b>	<b>4,210</b>

# 6. WAP: Net Verified Savings

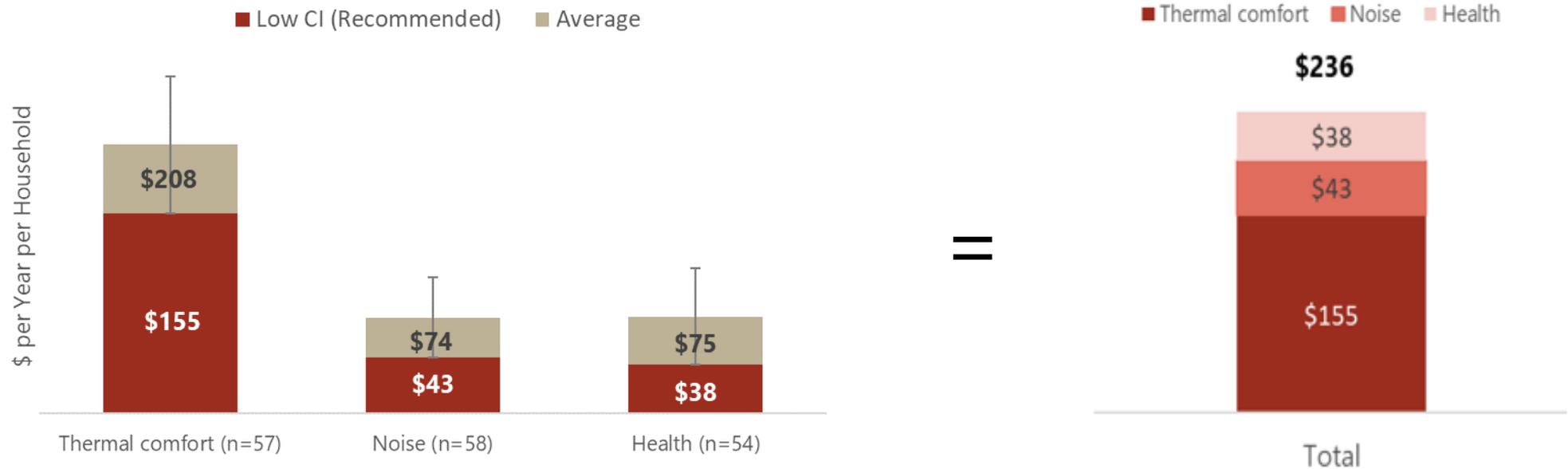
Heating Type	Home Type	Approved Low Income NTG	Net Verified Energy Savings (MWh)	Net Verified Peak Demand Reduction (MW)	Net Verified Fossil Fuel Savings (MMBtu)
Electric	Single Family	1.0	195	0.04	NA
	Manufactured Home	1.0	34	0.00	NA
Natural Gas	Single Family	1.0	101	0.02	895
	Manufactured Home	1.0	8	0.00	146
Other Fuel	Single Family	1.0	86	0.01	768
	Manufactured Home	1.0	139	0.03	2,400
<b>Total</b>			<b>562</b>	<b>0.11</b>	<b>4,210</b>

# 6. WAP: Per Home Savings Matrix

Heating Type	Home Type	Per Unit Energy Savings (kWh)	Per Unit Peak Demand Reduction (kW)	Per Unit Energy Savings (MMBTU)
Electric	Single family	2,073	0.42	NA
	Manufactured home	1,023	0.05	NA
Natural Gas	Single family	1,081	0.19	9.6
	Manufactured home	851	0.20	16.2
Other fuel	Single family	1,197	0.21	10.7
	Manufactured home	968	0.22	16.7

# 6. WAP NEBs Results

Use conservative NEBs estimates, but conduct follow-up research to reduce uncertainty and understand regional differences

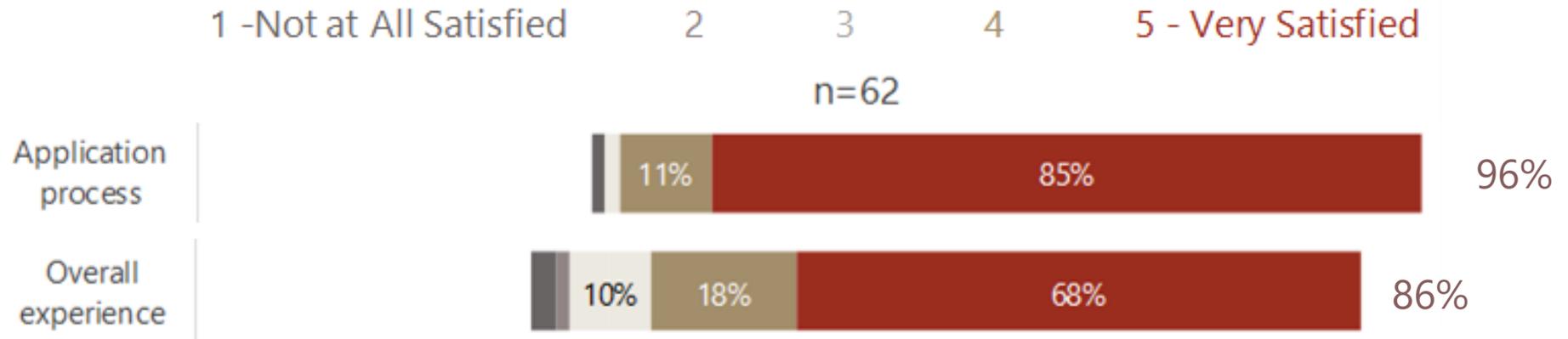


## 6. WAP: Evaluation Key Findings

- WAP achieved a **153%** realization rate for gross electric savings and an **84%** realization rate for gross fossil fuel savings
- WAP was found to be a cost-effective program with a TRC ratio of **1.71**
- Lifetime GHG reduction of **6,889** tons from projects completed in CY2016-2017

# 6. WAP: Process Evaluation Results

- High client satisfaction



- Subgrantees drive client program awareness
- Procedure manual and more accessible training might improve process efficiency

# 7. GEP: Program Summary

Program Year	Measure	Projects Completed	Capacity (MW)	Capacity (Tons)	Capacity (Sq. Ft.)
2016	PV	195	2	0	0
	Geothermal	30	0	171	0
	Solar Water	0	0	0	0
2017	PV	580	5	0	0
	Geothermal	25	0	137	0
	Solar Water	0	0	0	0
2018	PV	458	3	0	0
	Geothermal	14	0	75	0
	Solar Water	1	0	0	59
Total		1,303	10	383	59

# 7. GEP: Sample Frame Coverage

Project Type	Facility Type	Population			Sample			
		Projects	Capacity	Unit	Sample Points	Sampled Capacity	Unit	Percent Sampled
Solar PV	Non-Profit	16	0.4	MW	3	0.1	MW	28%
	Non-Residential	9	0.3	MW	3	0.1	MW	35%
	Residential	228	3.0	MW	10	0.2	MW	2%
		980	5.9	MW	12			
Geothermal	Residential	69	382.3	Tons	3	56.0	Tons	4%
Total		1,303			31			

# 7. GEP: Verified Results

Project Type	Facility Type	Verified Capacity Realization Rate	Verified Capacity	Unit	Relative Precision at 90% Confidence	Gross Verified Energy Savings (MWh)	Gros Verified Peak Demand Savings (MW)
Solar PV	Non-Profit	100%	0.4	MW	0.29%	623	0.4
	Non-Residential	100%	0.3	MW	0.29%	370	0.3
	Residential	99%	3.0	MW	0.29%	4,031	2.7
		100%	5.9	MW	0.29%	8,503	7.1
Geothermal	Residential	100%	382.3	Tons	0.15%	197	0.1
Total						13,725	10.7

# 7. GEP: Evaluation Findings

- The GEP achieved **13,725** MWh in first year energy savings (generation) through the completion of **1,303** projects
- Lifetime GHG reduction of **240,129** tons from projects completed in CY2016-2018
- The program database consistently reports key variables for GEP projects and is easy to navigate, but doesn't track energy generation
- EcoMetric found discrepancies between the nominal capacities of installed systems and the capacities documented in the models' AHRI certificates.
- Contractors do not list the system shading factors in the project documentation.

# Questions?

**Salil Gogte**

President

[salil@ecometricconsulting.com](mailto:salil@ecometricconsulting.com)

**Kyle McKenna**

Senior Energy Engineer

[kyle@ecometricconsulting.com](mailto:kyle@ecometricconsulting.com)

EcoMetric Consulting, LLC

555 Exton Commons

Exton, PA 19341

610-400-8600

# 6. WAP: Billing Analysis Work Flow

